VIIIRATION DAMPING OF THE CASSINI SPACECRAFT STRUCTURE

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ABSTRACT

Cassini is a robotic spacecraft currently under development at the Jet Propulsion Laboratory (JPL) whose interplanetary scientific mission is to explore Saturn, its rings, and its moons in the early 21 st century. Cassini, the largest spacecraft ever assembled at JPL, is scheduled to launch in October 1997 from Kennedy Space Center (Cape Canaveral, FL) on board a Titan IV rocket with a Centaur upper stage booster. Cassini will be protected during ascent through the atmosphere by a lightweight aluminum payload fairing (PLF). As a result of the extreme noise levels generated by the powerful Titan IV at liftoff, and the acoustic transparency of the PLF, Cassini is predicted to experience severe acoustic levels. Furthermore, the high acoustic levels, coupled with the size and configuration of the spacecraft, will induce intense random vibration levels on the structure and critical spacecraft components. Efforts to mit igate the vibroacoustic environment by modifying the spacecraft structure were pursued. Preliminary studies indicated that a structural damping treatment using viscoelastic materials (VEMs) represented a viable technique of reducing vibration with minimum impact to weight, cost, and redesign. Consequent y, an expert consultant was hired to assist with the damping design, and selection of the appropriate VEMS. Preliminary analyses showed that the use of Tuned Vibration Absorbers (TVAs) would bc effective in controlling vibration. TVAS arc compact single degree-of-freedom mechanical oscillators, in which a VEM serves as the spring and damping element. A series of reverberant acoustic tests were performed on a partial development test model of Cassini to evaluate the effectiveness of the TVAS in reducing the structural vibration. The operating principles, design, and installation of the TVAS are described, the test program is outlined, and test results are presented which show that significant vibration attenuation was achieved.